

1. Why would it be better to calibrate a thermometer using the temperature at the triple point versus the temperature at the melting point?

The melting point of a substance can vary with pressure. However, the gas, liquid, solid triple point can occur at only one temperature pressure point.

2. What is a critical point on a phase diagram?

Physical conditions (T, P) at which distinct liquid/gas phases cease to exist

Another way: The temperature and pressure at which the gas and liquid phases become identical is the critical point

3. Is the following the Clausius-Claperyon equation?

$$\ln\left(\frac{P_1}{P_2}\right) = \frac{\Delta H_{vap}}{R} \left[\frac{1}{T_2} - \frac{1}{T_1} \right]$$

Yes, $\ln(a/b) = -\ln(b/a)$ – properties of logarithms

Since $\ln(a/b) = \ln(a) - \ln(b)$

4. Ethanol C_2H_5OH and dimethyl ether CH_3OCH_3 have the same molecular weight (the same atomic makeup actually). What are the IMF you would find in each?

Which do you think would have the higher vapor pressure at 25°C? Which do you think has the higher normal boiling point?

Ethanol: H bonding, dipole-dipole, dispersion

Dimethyl ether: dispersion, [dipole dipole](#)

IMF (EtOH) > IMF (diethyl ether)

Diethyl ether would have higher vapor pressure at a given T, and a lower boiling point. Ethanol would have a higher boiling point than diethyl ether.

As IMFs increase, the boiling point goes up and vapor pressure goes down; remember, **normal boiling point** is when vapor pressure of the liquid equals 1 atm.

5. Why does water boil at a lower temperature in Denver?

Atmospheric pressure is lower than 1atm, b/c of increased elevation.

Since boiling point is when vapor pressure of the liquid is equal to the ambient pressure, and the ambient pressure is lower in Denver, water boils at lower T.

6. Which phase transitions are exothermic?

Condensation, freezing, deposition – molecules have lower enthalpies (energies) when they are “closer together”

By the same logic, vaporization, sublimation and fusion (melting) are endothermic phase transitions.

7 What information would you need to know to determine the amount of heat required to take a block of iron from 500 °C to liquid iron at 1800 °C?

enthalpy of fusion of iron

mass of iron block

iron specific heat capacity (solid)

iron specific heat capacity (liquid)

(or, instead of mass and specific heat capacities, mols of iron and molar heat capacities)

Katie Clark 1/27/11 6:10 PM

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8. Find a phase diagram and navigate around it with a friend.

Please do this.

9. Why is there no phase transition between a gas and a SCF?

A supercritical fluid (SCF) is any compound at a temperature and pressure above the critical values. However, the properties of a SCF fluid vary smoothly compared to a gas or a liquid. For a typical phase transition (liq to gas) there is a large change in enthalpy, entropy, volume,However, when a gas goes to a pressure and temperature above the critical point, there is not physical difference to observe. All the properties vary smoothly. Thus this is not a "phase transition"

10. Iodine sublimates at 298 K. Based on this do you expect the triple point to be at a higher or lower temperature? Or does it depend on the pressure?

The triple point of iodine will be at a higher T than 298K; For additional exercise, draw/visualize a simple phase diagram (and remember that sublimation is transition from solid to gas).

11. The vapor pressure of ethanol at 35°C is 0.132 atm. 10 g of liquid ethanol are placed into a 10L container at a constant temperature of 35°C and allowed to come to equilibrium. How many grams of liquid remain after the system comes to equilibrium (if any)?

$$n_{gas} = \frac{PV}{RT} = \frac{(0.132 atm)(10 L)}{\left(\frac{0.08206 Latm}{Kmol}\right)(308.15 K)} = 0.052 \text{ mol ethanol}$$

$$0.052 \text{ mol ethanol} \left(\frac{46 g}{mol}\right) = 2.4 \text{ g ethanol gas}$$

Therefore,

$$10 \text{ g ethanol total} - 2.4 \text{ g ethanol gas} = 7.6 \text{ g ethanol liquid remains at equilibrium}$$